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VIVISECTION AND THE USE OF REMEDIES.

IF we hear a discussion carried on with great vigour, and even acrimony, between two parties having similar objects in view, the chances are that the difference of opinion depends upon some misunderstanding. Such seems to be the case with the question of vivisection. On the one side we see numbers of kind-hearted men and women throughout the country earnestly endeavouring to put down the practice of experiments upon animals, because they believe that in such experiments excessive pain is wantonly or uselessly inflicted, and because they suppose that those who perform such experiments are thereby rendered cruel, hardened, and debased. On the other hand we see the medical profession, engaged every day in the endeavour to prolong life and to alleviate suffering, unanimously upholding the practice as absolutely necessary for the progress of their art.

Both parties are anxious to lessen the amount of pain and suffering in the world; but the one looks to the immediate and designed suffering of a few score of animals, the other to the ultimate relief of the undesigned pains of disease in animals and in men. Both parties are anxious that medical men should be humane and merciful, but they differ as to what is cruelty and what is not.

There can be little doubt that to most civilised people the mere sight of suffering is painful. But the effect of this painful impression varies in different individuals. In some it excites a desire to get away from the sight or thought of the pain, and thus be rid of the disagreeable feeling which it produces, with little or no regard to the fate of the suffering creature itself. In others it excites a desire to relieve the pain of the sufferer, however disagreeable, disgusting, or trying the task may be. It is easier to run away from pain than to relieve it, and there are those who pride themselves upon their own selfishness, and look down upon those who, instead of yielding to the natural tendency to shun the sight of suffering, overcome this impulse, and stay to give relief. In the old story of the Good Samaritan, the priest and the Levite who saw the unfortunate traveller lying naked, dirty, and covered with blood, upon the road, and who

carefully passed by on the other side, away from the disgusting object, would no doubt regard with scorn, as possessing a coarser nature, the good Samaritan, who not only approached the sufferer, but, prototype of antiseptic surgery, poured oil and wine into his wounds, in spite of any sign of temporary pain which the applications might occasion. This power of controlling one's own emotions, of disregarding one's own feelings at the sight of suffering, and of thinking only of the relief which we can give, varies in different individuals, but it can be greatly increased by training. Thus we find that medical students not unfrequently faint at the sight of a surgical operation. Even delicate women learn by training to neglect their own feelings, and to act the part of the good Samaritan: yet I think few will venture to say that Florence Nightingale and the noble women who aided her were rendered callous or debased by their efforts to relieve the sufferings of our wounded soldiers during the Crimean campaign.

The practical surgeon or the experienced nurse is not less tender-hearted than the medical student or the young probationer, because they do not shudder or grow pale at the sight of the patient's sufferings, and because they are even able with a firm hand to inflict upon him present pain for the sake of his future benefit. They have simply learned to disregard their own feelings, and to concentrate their attention on the interests of the patient. They are guided no longer by emotion, but by judgment.

There are several reasons why the medical profession has assumed such a decided attitude on the question of vivisection; and why the mere fact of having received a medical training and being in the daily practice of alleviating human suffering causes humane men to commend the practice, which other humane men, not having received the same training, denounce as atrociously cruel. Firstly, their training and daily experience lead them to subordinate their feelings to their judgment, and make them willing to purchase future good at the expense of present pain. Secondly, they know how great is the amount of suffering inflicted upon human beings by disease. Thirdly, they know that much of their ability to relieve suffering has been derived from experiments upon animals, and that such experiments are likely to render still more service in the future. This knowledge makes them not only willing, but anxious to increase their power to relieve human beings, even at the expense of some suffering to the lower animals. Fourthly, they know how greatly exaggerated is the popular conception of the pains inflicted by experiments on animals. They know that many of them, such as feeding with varied diet or administering drugs, are absolutely painless; that others, like testing the actions of poisons and deadly vapours, are merely the most merciful mode of destroying life, and that of the remainder, the great majority are by the practice of physiologists, now enforced by the law of the land, rendered painless by means of anæsthetic agents.

The reason, it appears to me, why those who have not had a medical training are desirous of putting a complete stop to all experiments upon animals, or of throwing every obstacle in their way, is chiefly that they neither understand what benefits have been gained by 'vivisection,' nor have they any idea of the amount and intensity of the pain inflicted upon human beings by disease. They are, therefore, unable to form any just *comparison* between the pain inflicted by experiments on animals and the pain which, by means of those experiments, may be prevented or relieved. Some there are, no doubt, whose judgment is entirely subordinated to their feelings, and they, like the priest and the Levite, will pass by on the other side, shutting their eyes to the sight of preventable human suffering and stopping their ears against the voice of reason. These persons, I believe, are comparatively few. The great majority of those who denounce vivisection do so simply from ignorance, and only require to become acquainted with the good that is obtained through it, in order to join with the medical profession in recognising its necessity.

It is impossible, in the space of a single article, to convey to those who have no medical knowledge an adequate idea of the uses of 'vivisection' in enabling us to relieve disease.

What Professor Humphrey very truly said of physiology in his Address to the British Medical Association in August 1881, 'Almost every advance in our knowledge of the workings of the human body has been made through vivisection,' may almost equally be said regarding our exact knowledge of the action of remedies.

Here I would draw attention to the word 'knowledge,' which Professor Humphrey employs, for in it lies the essence of modern medicine. To some persons the distinction between thinking, believing, and knowing may seem to be slight, but the difference would be impressed upon them in a forcible way if they should arrive at a railway station just in time to find that the train which they thought left at the hour, which they believed would certainly depart at the hour, was actually timed, as they might have known by the use of proper means, to leave five minutes before the hour. The difference between thinking and knowing is, in such a case as this, very evident. But it becomes enormously important when upon it depends the life of a fellow man. No one feels this so keenly, for no one perceives it so clearly, as the medical man himself, to whom his suffering or dying patient appeals for aid. Often does the confidence which the patient reposes in his skill make the physician sigh for the exact knowledge which would enable him to do what is certainly best, instead of doing only what, in the present imperfect state of medical knowledge, is likely to be best.

The reproach has not unfrequently been brought against medical men that their treatment consists in pouring drugs of which they know little into bodies of which they know less. There was at one

time only too much truth in this reproach, and, unfortunately, it is not even now entirely groundless. But we have learned a good deal about the bodies that we have to treat, and we have also learned a good deal about the drugs with which we treat them.

Exact knowledge of the best methods of treating disease can only be acquired by experiment, and in our endeavours to attain this knowledge there are various lines of experiment open to us. First of all, we may experiment upon our patients; and this is the plan which was formerly almost exclusively adopted, when remedies were administered for the most fanciful reasons, without previous knowledge of their action or of the real nature of the disease. Even now we are occasionally obliged by the imperfection of our knowledge to follow this tentative method. But the phrase 'experiment upon patients' has an ugly sound to those who do not understand what it means, and many a one would object most strongly to being 'experimented upon,' who would at once consent to the proposal that, if one medicine did not succeed, another should be tried. 'Trying' one drug where another fails is itself an experiment. Yet there is a distinction which justly leads patients to object to experiments on themselves, and doctors to resent the imputation of making them. For in 'trying one drug after another,' the object in view is the welfare of the patient, and the medicines employed are those which are most likely to do him good. But 'experimenting' on him with the same remedies involves the idea that the drugs are given, not for the patient's good, but only for the acquirement of knowledge. It is because physicians feel that they have no right to make use of a patient simply as a means of gaining knowledge when he is looking to them for aid, that they justly refuse to try modes of treatment upon their patients without having first used every possible endeavour to learn by other means that they are likely to succeed; and, even when they are obliged to treat tentatively, they use only such drugs as are likely to benefit, or, at least, unlikely to do harm. The line of experimentation upon patients is thus very strictly limited. It can correct, confirm, modify, or improve a mode of treatment previously arrived at by tradition or by scientific investigation; but it is almost useless for the purpose of active progress.

The next line is that of experiment upon healthy persons, and this practically comes to medical men experimenting upon themselves. To what extent they have sacrificed themselves in such researches may be seen by reading the experiments of Heinrich and Dworzak under the direction of Professor Schroff. But here also the extent of the method is limited, for experimenters on new drugs in their own persons not only run the risk, like the late Sir Robert Christison, of sacrificing valuable lives without any corresponding advantage, but they are unable to discover upon themselves the exact mode in which the drug affects the organs of the body, which is precisely the know-

ledge they require in order to apply it to the best advantage in disease.

The only way, then, that is open, is experiment upon animals ; and, feeling that much has been gained by this line of research in the past, we unanimously declare that it must not be forbidden in the future, since it is indispensable to the progress of medical science, and the consequent alleviation of human suffering.

It will be easier for unprofessional readers to understand the use of experiments on animals in helping the practice of medicine, if I give one or two examples to show how the various branches of knowledge are required for the treatment of disease, and how experiments, apparently useless in themselves, may ultimately lead to the alleviation of human suffering.

Frequently, on entering a sick room or hospital ward, we may see a man propped up in bed, with livid face and bluish fingers, gasping for breath, hardly able to move his heavy, swollen limbs, so as to relieve the tiresomeness of his position. He cannot lie down for want of breath ; and even when, wearied out, he is overpowered by sleep, he has hardly shut his eyes before he is awakened with a start by a feeling of impending suffocation. To most people the difficult respiration would probably suggest something wrong with the lungs, for few in this country are without physiological notions of some kind or other. The physician, however, on placing his stethoscope to the chest, finds that the lungs are not much in fault, but that one of the ordinary sounds of the heart is replaced by a puffing noise. As the result of experiments upon animals he knows that this indicates a definite disease of one of the valves of the heart ; and other experiments have shown that retarded circulation through the lungs, from interference with the heart, will produce shortness of breath. Partly from other ‘vivisections,’ and partly from the ravages of disease upon man himself, he knows that the swollen dropsical legs and the feeble pulse are also dependent on the same condition. The physician is therefore able to say with certainty what condition of the patient’s organs causes his distress and danger. This he is enabled to do by a knowledge of the process of circulation in the healthy body, derived from experiments upon animals, by a knowledge of the effects which morbid alterations of it produce, also derived from experiments upon animals, and from a knowledge of the indications of these changes, also derived from experiments upon animals. But he has not yet attained his end—the cure of his patient. For this he is again indebted to experiments upon animals. It is now more than a hundred years since a medicine, *digitalis*, derived from the common foxglove, was accidentally discovered to be useful in dropsies, but it was not known in what kind of dropsy it should be employed, for in some it was beneficial, in others almost useless, and in a third class of cases dangerous. The

uncertainty of its action led to its banishment, but the good that it did caused it to be reintroduced into medical practice; and so for many years it was regarded as a powerful but uncertain and treacherous weapon. So lately as twenty years ago the mode of using digitalis was still disputed. It was regarded by some as a cardiac sedative, to be used in depressing the circulation when too strong, by others as a cardiac stimulant, useful in increasing the power of the heart when too weak. About that time, however, the experiments made with this drug upon animals by Traube and others, showed that these discrepancies of opinion arose from the fact that digitalis slowed the heart, at the same time that it strengthened it, while still larger doses weakened the heart or stopped it altogether. This exact knowledge of its mode of action enables us to select the cases in which digitalis will be useful, to avoid it altogether where it will be dangerous, and to adopt such precautions as will ensure benefit while avoiding risk.

Strychnia was one of the first drugs introduced into medical practice through vivisections. Its action, previously unknown, was investigated by Magendie, who found that it stimulated the spinal cord. He therefore thought that it would be useful in paralysis, and from that day to this it has remained a powerful remedy. But this is not the only use of this drug. Some years ago, Prokop Rokitsansky made several experiments on the action of strychnia upon animals, and found that not only did it render the respirations more powerful, but that instead of their ceasing altogether (as they generally do, when the spinal cord is divided in the neck) they still continued to a slight extent. He also found that when the spinal cord was first divided, and the respiratory movements were thus arrested, the injection of strychnia caused them slightly to recommence. 'Here,' an anti-vivisectionist would say, 'is an example of perfectly useless cruelty—a dog tortured by having its spinal cord cut through and by having strychnia injected into its blood; of what possible use can such experiments be?' A few years afterwards, another observer found that when dogs were nearly suffocated, their paws began to perspire; but if the nerve going to one of them was divided, that paw remained dry, while the others became moist. In this way he was able to show that the secretion of sweat depended upon nervous influence passing along the nerves from the spinal cord to the skin, and that this action was excited when the blood was rendered venous by partial suffocation. Here, again, one might say, is another example of useless cruelty—painful experiments productive of no benefit. But let us see whether this be so or no. In consumption—that fatal scourge of this country, which seems to choose for its victims the fairest and best—some of the most distressing symptoms are the profuse night sweats, and the painful prostration which accompanies them. How are they to be relieved? The ex-

periments of Luchsinger have shown that insufficient aëration of the blood will cause sweating, while those of Rokitansky prove that strychnia increases the respiratory movements. If then we should give strychnia at bed time to the consumptive patient, we should prevent the sweats. We try it accordingly, and the result shows that the practical deductions from these apparently useless experiments on animals are correct, for the sweats cease, and the prostration disappears.

Thus, experimentation upon animals enables us to use with certainty and success remedies like digitalis, which have long been known but at first were employed haphazard, and to utilise their powers for the treatment of diseases in which they were not formerly employed. But to it also we owe the introduction of the most valuable of our new remedies. This is, perhaps, best seen by examining the additions to the British Pharmacopœia, which is the authorised list of medicines and their compounds used in the United Kingdom. One edition of this was published in 1864, another in 1867, and in 1874 an appendix containing the latest additions. On comparing the edition of 1867 with that of 1864, we find that along with a number of compounds and preparations of remedies contained in previous pharmacopœias, there are seven new drugs—carbolic acid, bromide of ammonium, iodide of cadmium, oxalate of cerium, physostigma, sumbul, and veratrum viride. The bromide of ammonium, although a most useful drug, may be regarded as being not so much a new remedy as another form of bromide, the potassium salt being contained in previous pharmacopœias. If we except this, we find that we owe the two most useful remedies in this list, viz., carbolic acid and physostigma, to experiment.

The action of carbolic acid was first systematically investigated by Lemaire, and its application by Lister to surgery is one of the greatest boons to humanity of modern times. Of its importance in antiseptic surgery no one can be ignorant.

Physostigma is a bean used as an ordeal poison in Calabar. In testing its action upon himself, Sir Robert Christison had a narrow escape from death; but by experimenting on animals, Dr. Fraser established its power of contracting the pupil of the eye, and of depressing the action of the spinal cord. It is now daily used in cases of eye disease. It has given relief in tetanus, and has been found to lengthen the duration of life in general paralysis.

If we take the additions to the Pharmacopœia between 1867 and 1874, we find eleven new remedies. These are acetic ether, nitrate of ammonia, nitrite of amyl, areca, hypophosphite of lime, chloralhydrate, gutta percha, larch bark, phosphorus, pepsin, and hypophosphite of soda.

Nitrate of ammonia is merely introduced for the purpose of making nitrous oxide, a most useful anæsthetic, which was discovered by

experiments upon healthy men, and not upon animals. Of the remainder, the three most useful are pepsin, chloral, and nitrite of amyl.

Pepsin is the ingredient to which the secretion of the stomach chiefly owes its digestive powers, and its introduction into medicine is entirely due to the knowledge which we now possess of the digestive processes. With the exception of an experiment accidentally made upon man (in the famous case of Alexis St. Martin), we owe our knowledge of the digestive function almost entirely to experiments upon animals.

Chloral-hydrate was first employed in medicine by Liebreich, who was led by a knowledge of its chemical nature to think that a dose of it, taken by the stomach, would have much the same effect as very small quantities of chloroform continuously administered. He tried it upon animals, and found that the effect was very much what he supposed. It produces sleep, and in large doses destroys sensibility; but when used in such quantities as to produce this effect, it is attended with great danger, and sometimes fatal consequences have occurred. We now know, by further experiments upon animals, that the risk attending it is due to its depressing effect on the heart, respiration, and animal heat. We also know, by experiments on animals, that these effects can be to a considerable extent counteracted by the application of external warmth, and by this knowledge life has been saved in at least one case where an overdose had been taken.

In that exceedingly painful and distressing disease, angina pectoris, the agony which the patient suffers is intense, and until the introduction of nitrite of amyl no drug was known which could afford much relief. The progress of physiology having rendered it possible to judge of the tension in the blood-vessels, it was found that this was greatly increased during the paroxysm. It seemed likely that this increase in tension was the cause of the pain, and that anything which would diminish it would relieve the sufferer. Experiments upon animals had shown that nitrite of amyl possessed this power. It was accordingly tried, and the result has completely justified the anticipations to which the experiment had led, for it gives almost instant relief.

To experiments upon animals, then, we owe not only a more accurate knowledge of the human body in health and disease, of the significance of the symptoms with which we meet at the bedside, and of the various remedies which have long been employed, but also the introduction of nearly all the most valuable new remedies which have been added to the *Pharmacopœia* since the year 1864. I might add to those that I have mentioned many other new remedies which are still on their trial, and which will, in all probability, be added to the next edition of the *Pharmacopœia*; but I think it better to confine myself to those which are already officially recognised. When we find that practically every important addition since 1864 to

the remedies used to prolong human life and alleviate human suffering has been made by the help of experiments, it is surely not wonderful that we, who have the serious duty of meeting the demands of suffering humanity, should unanimously demand that competent men shall not be hindered in forwarding the progress of the healing art by one of its most indispensable means. Nor will many be found to oppose that demand when once the merits of the case are thoroughly understood.

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